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(71) Applicant (*for all designated States except US*): **MOTOROLA LIMITED** [GB/GB]; Jays Close, Viables Industrial Estate, Basingstoke, Hampshire RG22 4PD (GB).

(72) Inventors; and
(75) Inventors/Applicants (*for US only*): **THOMAS, Howard, John** [GB/GB]; 8 The Avenue, Cirencester. Gloucestershire GL7 1EJ (GB). **OWEN, Raymond** [GB/GB]; Flat 3, 11 Station Road, Bath BA1 3DY (GB). **O'NEILL, Rorie** [GB/GB]; 29 North Street, Swindon, Wiltshire SN1 3JX (GB).

(74) Agents: **POTTS, Susan** et al.; Motorola European Intellectual Property Operations, Midpoint, Alencon Link, Basingstoke, Hampshire RG21 7PL (GB).

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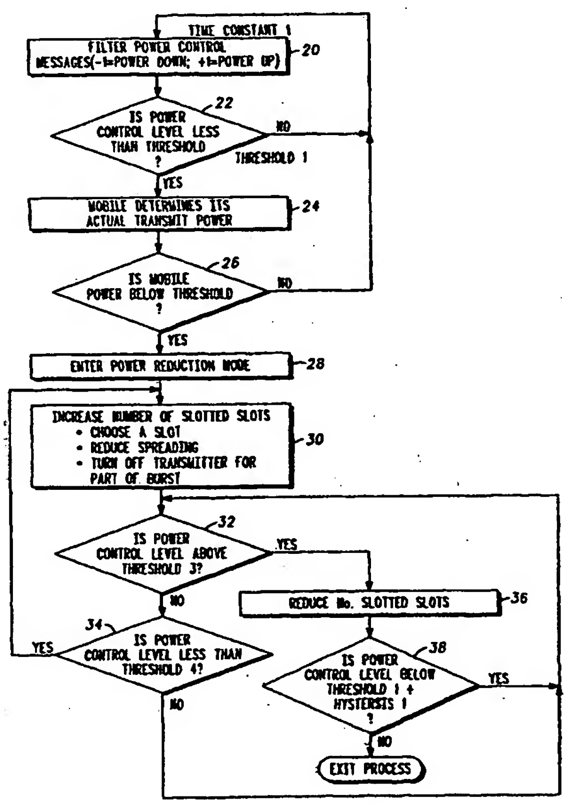
[Continued on next page]

(54) Title: REDUCTION OF TRANSMIT POWER IN A MOBILE STATION



(57) Abstract: A method of setting the transmit power of a mobile station operating in a radio communication system is provided. Communications are effected to a plurality of mobile stations via at least one base station. The method includes the steps of operating the mobile station in a first power control mode and receiving a message at the mobile station, transmitted by the at least one base station, the message informing the mobile station to reduce the transmit power of the mobile station below a lower threshold level of a power control range in the first power control mode. The mobile station then operates in a second power control mode, in response to the message. In utilising this method, the mobile station can still continue its transmissions, even though its transmission power may be outside of the minimum power threshold level of a power control range.

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REDUCTION OF TRANSMIT POWER IN A MOBILE STATION

Field of the Invention

The present invention generally relates to radio communications systems and particularly though not exclusively to transmissions in cellular communications systems employing a Code Division Multiple Access (CDMA) technique.

Background of the Invention

In a cellular radio communications system, a plurality of base stations provide radio telecommunications services to a plurality of mobile subscriber units. Each base station defines a particular geographical area or cell proximate to the base station to produce coverage areas. The communications link from the base station to a mobile subscriber unit is referred as to the down-link. Conversely, the communications link from a mobile subscriber unit to the base station is referred to as the up-link.

Multiple access techniques permit the simultaneous transmissions from several mobile subscriber units to a single base station over a plurality of communications channels. Some channels are used for carrying traffic and other control channels are used for transferring control information, such as call paging, between the base station and the subscriber units.

Some examples of multiple access techniques are frequency division multiple access (FDMA), time division multiple access (TDMA) and code division multiple access (CDMA).

An example of a TDMA system is the global system for mobile communications (GSM) in which a time frame is divided into eight different time slots. Each subscriber unit is allocated one specific time slot for communication to the base station in this repeating time frame.

A CDMA system employs spread spectrum signaling. Two categories of spread spectrum communications are direct sequence spread spectrum (DSSS) and frequency hopping spread spectrum (FHSS). In the case of DSSS for example, the spectrum of a signal can be most

easily spread by multiplying it with a wide-band pseudo-random code generated signal. It is essential that the spreading signal be precisely known so that the receiver can de-spread the signal. A cellular communications system using DSSS is commonly known as a Direct Sequence Code Division Multiple Access (DS-CDMA) system, according to the TIA-EAI standard IS-95. Individual users in the system use the RF frequency but are separated by the use of individual spreading codes. Hence, multiple communications channels are allocated using a plurality of spreading codes within a portion of the radio spectrum, each code being uniquely assigned to a mobile subscriber unit, except for common channels.

For the next generation of mobile multi-media communication systems (known as Universal Mobile Telecommunications System (UMTS), CDMA2000 or Globalised Third Generation (G3G)), a Frequency Division Duplex CDMA (FDD-CDMA) method of dividing up the communication channel is the one chosen for standardisation. In the FDD method, the up-link and the down-link use different carrier frequencies. Additionally, a further mode of operation is being standardised within G3G. This mode of operation is a hybrid DS-CDMA and TDMA method. This mode of operation uses a Time Division Duplex (TDD) technique where the same frequency is used for both up-links and down-links.

One feature of the current GSM system, and which is also envisaged for UMTS, allows the transceivers in the base station and subscriber unit to adjust their power output to take into account of the geographical distance between them. The closer the subscriber unit is to the base station's transceiver, the less power it and the base station's transceiver will be required to transmit. This "power control" feature saves battery power in the subscriber unit and also helps to reduce interference effects. Both up-link and down-link power settings can be controlled independently.

Initial power settings for the subscriber unit, along with other control information, is set by the information provided on a broadcast control channel (BCCH) for a particular cell. The base station controls the transmit power of both the subscriber unit and the base station's transceiver. The base station monitors the received subscriber unit's power and the power received from the base station's transceiver at the subscriber unit is monitored by the subscriber unit and then reported to the base station. Using these measurements the power of both the subscriber unit and the base station's transceiver can be adjusted accordingly to minimise the transmit power needed by both parties and minimise the interference effects. The broadcast control channel is transmitted by the base station's transceiver at all times and

at constant power. In addition to a power control indicator, the BCCH also carries other information such as cell identity, a list of frequencies used in the cell, and a list of neighbouring cells to be monitored by the subscriber unit.

Discontinuous transmission (DTX) is a known method of reducing interference in both TDMA and CDMA radio transmission systems carrying voice traffic by switching off the up-link and down-link transmissions during periods when a speaker is inactive. DTX can only be applied to speech. For WB-CDMA during "quiet" (no speech activity) frames the DPDCH is switched off and hence the average transmission power is reduced. However there is a necessity to keep transmitting the DPCCH so that the fast power control loop can continue to operate in a converged fashion.

Accurate reverse link power control is a critical element of CDMA systems as the spreading codes are not orthogonal on the reverse link and any errors in power control produces interference that directly reduces system capacity.

The G3G FDD interface is based on wideband-CDMA. As such, it is sensitive to power control mismatches in the up-link because of the channel fast fading. Fast fading is a known and generally undesirable phenomenon caused by the signal arriving at a receiver via a number of different paths. Therefore, in order to achieve maximum up-link capacity in a CDMA system, fast power control loops are required.

An inner power control loop adjusts the mobile transmission power to counter the so-called near-far problem. This simply means adjusting the transmission power of each connection such that the received signal power observed at the basestation (or Node B in 3G context) is *just* sufficient to meet the QoS (Quality of Service) requirement of each particular connection; thereby reducing interference to others in the system. The function of the inner loop can be explained in more detail as follows: The inner power control loop adjusts the mobile's transmission powers in order to keep the received reverse link signal to interference (both user and thermal noise) ratio (SIR) as close to constant as possible.

In the general soft/softer handover case each serving cell makes a measurement of the uplink SIR, which is subsequently compared to a predetermined threshold. If the SIR estimate exceeds the predetermined threshold then the TPC command, transmitted on the forward link, is a '0'. Conversely if the measured SIR is lower than the threshold then a '1' is transmitted.

A forward link TPC command is generated and transmitted every 0.666 ms. In response to the forward link TPC commands the UE forms a single composite TPC command. The combining process is conditioned on knowledge of whether forward link TPC bits should be the same or different. This corresponds to the softer and soft handover cases respectively.

Several stages of combining may be necessary depending on the scheme adopted. However after a single composite command has been generated the mobile will either power up or down by a predetermined step. The step size is expected to be in the region of 0.25:1 dB, although it is not limited to this range.

The predetermined threshold to which the inner loop SIR measure is compared is generated by the outer, quality driven, power control loop. This loop basically sets a target SIR threshold that is commensurate with the required QoS (Quality of Service) for a given connection (usually defined in terms of target BER or FER). This target will vary as propagation conditions change. For example each mobile's speed and its specific propagation environment will both have a major impact on the SIR required at the basestation to maintain the desired QoS.

The inner loop simply adjusts the transmit power from a mobile to achieve the desired received SIR observed at the basestation. The actual transmit power of the mobile has a fixed dynamic range dictated by practical size and cost constraints. This means that the transmit power of the mobile is constrained to lie somewhere within this range. If the mobile is situated close to a basestation which it is communicating with, then the path loss between the mobile and the base will, in general, be low, meaning that the transmission power of the mobile to achieve a given SIR can also be low. A situation can arise where a mobile close to a basestation reaches its minimum transmit power and is still transmitting too much power such that the received SIR at the basestation is excessive. This leads to excessive QoS for this connection but at the expense of system capacity and cell range; since far out mobiles will have to increase their, finite, transmission power to overcome the extra interference generated by the close in mobile. This may mean that they reach maximum transmit power without achieving their desired SIR, hence their only option is to drop their data rate. Even if they can achieve their desired SIR (which is most likely if the desired loaded cell range has been set based on capacity considerations) then they are generating extra interference in neighbouring cells, reducing overall system capacity. There is a practical design constraint on the minimum

value of mobile radio terminals since there is a minimum power of the in-band signal power and wideband noise power that any given mobile terminal architecture can achieve.

FIG. 1 is a graph 10 showing a computer simulation used to derive the relationship between noise rise with cell loading 14 as a function of the minimum transmit power level 12 allowed for mobiles in the system. The parameters of the simulation are described 'FDD UE minimum transmission power simulation results in TSGW4#6(99) 395 presented in TSG-RAN Working Group 4#6, South Queensferry, Scotland (26-29'th July 1999).

Noise rise is defined as the rise in total noise power observed in the carrier bandwidth (due to all users connected to the basestation plus thermal noise) over background thermally generated noise in the carrier bandwidth (which is irrespective of the number of users). When the noise rise reaches a certain level 16 above thermal noise, the transmission power requirements of users connected to the basestation rises rapidly to infinity, this is known as the pole capacity of the cell.

In such a situation, it is desirable to load as many users onto the system as possible, namely load the system as close to pole capacity as possible. In practice, the system needs only be loaded to a fraction of pole loading in order to ensure power control stability. FIG. 1 shows that for a given capacity the lower the allowed minimum mobile transmit power the lower the noise rise. This means greater system capacity, range and increased mobile battery life.

A need therefore exists, in certain situations, to drop the minimum transmission power of mobiles below a perceived design minimum, currently fixed at -44 dBm in the UMTS standard. A possible solution to this problem is to alter the architecture of the mobile, however this would incur an undesirable cost premium since more expensive radio frequency components will be required.

Summary of the Invention

According to the to a first aspect of the invention there is provided a method of setting the transmit power of a mobile station operating in a radio communication system. Communications are effected to a plurality of mobile stations via at least one base station. The method includes the steps of operating the mobile station in a first power control mode and receiving a message at the mobile station, transmitted by the at least one base station. The message informs the mobile station to reduce the transmit power of the mobile station below a lower threshold level of a power control range in the first power control mode. The mobile station operates in a second power control mode, in response to the message.

In this manner, once the mobile station is instructed to reduce its transmit power below a power control threshold level of the system, the mobile station switches to a second power control method of operation.

Preferably, the method further includes the step of the mobile station detecting when the mobile station's transmit power reaches a lower threshold level within a power control range. In this manner, the mobile station then controls its own transmit power level, as compared to current methodology which ascribes to the system dictating mobile station's transmit power levels using a particular power control method.

In a preferred embodiment of the invention, the method of setting a transmit power of a mobile station includes the mobile station entering into a time discontinuous mode of transmission as the second power control mode. This is effected by the mobile station, in response to the message, thereby enabling the mobile station to transmit at a power level below the lower threshold level and remain in communication with the at least one base station. When the communication system is a Code Division Multiple Access System, this time discontinuous mode of transmission may include a slotted mode of operation whereby the mobile station transmits at the same power level, in half the time, thereby reducing the average transmit power. Alternatively, or concurrently, the time discontinuous mode could be a slot deletion mode of operation. User data and/or control information can then be slotted in to available transmit slots.

In a further preferred embodiment of the invention, the method includes the mobile station transmitting at a higher data rate as the second power control mode, in response to receiving

the message, to utilize the excess received power usefully to allow reception of more useful user data.

In a yet further preferred embodiment of the invention, after the mobile station has entered the second power control mode of operation, the method further includes the step of receiving a second message at the mobile station. The second message requests the mobile station to increase its transmit power to a level that would correspond to a level above the threshold level for continuous transmission power. The mobile station remains in the second mode of power control until several successive messages indicate that the mobile station should increase its transmission power level. Hence, oscillatory behaviour between modes is eliminated.

In a second aspect of the present invention a mobile station operating the previously described method is provided.

In a third aspect of the present invention a communications system operating the previously described method is provided.

A preferred embodiment of the invention will now be described by way of example only, with reference to the drawings.

Brief Description of the Drawings

FIG. 1 shows the result of a prior art computer simulation used to derive the relationship between noise rise with cell loading as a function of the minimum transmit power level.

FIG. 2 shows a flowchart of power level setting of a mobile station in accordance with a preferred embodiment of the invention.

Detailed Description of the Drawings

Referring first to FIG. 2, a flowchart of power level setting of a mobile station, in accordance with a preferred embodiment of the invention is shown. The mobile station receives power control messages from the base station, as shown in step 20. An example of the message is for a step down in transmit power level being indicated by a "-1" and a step up in transmit power level being indicated by a "+1". If the power control level, being defined as the sum of N successive power control commands (in range +N). Otherwise, the mobile station continues to receive messages in the first mode of power control, as shown in step 20. If the mobile station's transmit power level is below the predetermined threshold, as in step 26, the mobile station enters the second mode of power control – power reduction mode – as shown in step 28. Otherwise, the mobile station continues to receive messages in the first mode of power control, as shown in step 20.

Once in the second mode of power control, the mobile station has a number of options to maintain communication with the base station, whilst effectively reducing the mobile's station transmit power beyond the minimum threshold level. These options include:

(i) entering a slotted mode, in a CDMA system, and successively increasing the number of slotted slots;

(ii) selecting a slot, or successive slots, for deletion;

(iii) reduce the spreading of the transmit signal, if in a CDMA system; and/or

(iv) turning off the transmitter for part of a burst,

as shown in step 30. The transmit power control level is then determined to see if it is above or below particular thresholds, as shown in step 32 and 34. Depending upon the determination, the mobile station can then successively repeat one or more of the steps in step 30, e.g. by reducing the number of slots as shown in step 36. In a complex communication system, where power control has to be effected extremely fast, some hysteresis may exist. If such a situation exists, the method takes this into account before deciding whether to exit the process, as shown in step 38.

The preferred embodiment of the invention relates to a method of reducing the minimum transmission power of a mobile, the general mechanism being as follows:

1) The mobile station detects that it has reached its minimum transmission power.

2) The mobile now monitors the power control commands sent from the basestation over the forward link. If a given number of successive power control commands (one or more) is downward (i.e. the mobile station is reasonably confident that the basestation is receiving excess power) then the mobile modifies its RF transmission by implementing the following:

(i) Deleting one out of every *N* successive timeslots. An even distribution over the radio frame is the preferred option to maximise the efficiency of interleaving. However this need not be the case. The deletion may be of just the user data (DPDCH) or user data and control channel information (DPCCH). The mobile continues monitoring power control commands sent from the basestation.

(ii) If the trend is still downwards then the mobile increases the frequency of the deletions until a point is reached when the trend of power control commands sent from the basestation indicates no change in power is required.

1) Once steady state has been reached the mobile continues transmitting with the appropriate number of deleted timeslots. It continues monitoring the basestation power control commands and when it observes that there is a trend indicating that the mobile should increase its transmission power then it reduces the frequency of deletions (in the reverse process to that outlined in point 2) until the power control commands indicate that no net change in power control commands is required. If the point is reached when no deletions are left then normal closed loop power control operation is resumed.

In normal closed loop power control operation mode the mobile responds to each power control command transmitted over the forward link. However it is well recognised that the Bit Error Rate (BER) of the power control commands will be in the region of 1-10%. This is the reason for observing several successive power control commands before moving into deletion mode (even though the mobile has reached minimum transmission power) or changing the deletion frequency.

Once the mobile has entered the deletion condition mode then there are at least two options to deal with individual power up commands. First option is to increase the mobile transmission power, by the power control step size, upon receiving each individual upwards power control command with fixed deletion frequency. In this case the mobile should also follow all

downwards power control commands. Secondly, ignore the upwards power control command whilst in deletion mode and only decrease the deletion frequency when sufficient upwards commands are detected in *M* successive power control messages.

In the first case, the next power control command after a deleted slot should be ignored anyway because the basestation will be making a received SIR estimate purely on noise[1].

In the embodiment described there is no requirement to signal the basestation that the mobile has entered slotted mode since the Forward Error Correction (FEC) takes care of the deletions. However in a second embodiment the basestation is informed which slots are deleted since it can them use this information to enhance the decoding process (i.e. purely noise samples do not enter the channel decoder, we simply set the appropriate sample to zero, as with conventional puncturing). In addition the basestation knows if a deletion means just user data is deleted or both user data and control information. With this knowledge it knows if it should make a received Eb/No estimate on the deleted slots and can take the appropriate action in other receiver functions.

In this embodiment of the invention, it can be seen that a variation of DTX has been applied to other services, through slot deletion. In addition, the mobile station's transmit power can be completely switched off, even though we are operating in a WB-CDMA context.

A further option that becomes viable, when the basestation is signalled that the mobile has reached minimum transmit power and is still being informed to reduce its power further, is to use a compressed or slotted transmission mode analogous to that used on the up-link. Such compression allows monitoring of other systems (TDD mode and DCS 1800). In such a compressed mode, the mobile reduces the spreading factor of the service by a factor of two and increases the transmission power by 3 dB by creating transmission gaps, e.g. by creating two successive slots. This allows creation of a slot's worth of time to do monitoring, without loss of any data.

The compressed mode is not a form of DTX, since one is simply transmitting at a higher rate for a fraction of the time.

[1] The method used by the basestation to estimate the received SIR is proprietary. Hence even if we do not delete the control information we cannot be sure that the next power control command issued form the basestation is correct since it may have made a measurement on non-existent data.

For the purpose of this invention the compressed sections do not have their transmission power increased. Additionally, the amount of compression may be variable to give finer granularity as a combination of slot deletions and compression can be used to keep the transmitted average power below the minimum possible with continuous transmission. Also the compressed mode may be applied just to the user data (DPDCH) or both the user data and the control information.

If the spreading factor for both the DPCCH and DPDCH are decreased by a factor of two in each slot we can reduce the average transmission power by 3 dB allowing us to reduce the mobile transmit power to -47 dBm (based on the current minimum mobile transmit power definition).

Finally in another embodiment upon signalling the basestation that the mobile has reached minimum transmit power and is still being informed to reduce its power further it is commanded to increase its data rate by the UTRAN. At fixed transmission power, increasing the rate will reduce the energy per information bit received at the basestation. Through rate adaptation we can match the received SIR to the desired QoS and reduce the time for which a mobile is transmitting. This option is only appropriate for some classes of service; for example Non Real Time (NRT) services which can tolerate a variable bit rate connection. If upon increasing the transmission rate the mobile is still transmitting at minimum power then the average transmit power may be reduced by using the slotting or slot deletion strategies outlined in this invention.

Thus an improved method of setting the power levels in a mobile station is provided.

Claims

1. A method of setting the transmit power of a mobile station operating in a radio communication system whereby communications are effected to a plurality of mobile stations via at least one base station, the method comprising the steps of:
   operating the mobile station in a first power control mode;
   receiving a message at the mobile station, transmitted by the at least one base station, the message informing the mobile station to reduce the transmit power of the mobile station below a lower threshold level of a power control range in the first power control mode; and
   operating the mobile station in a second power control mode, in response to the message.

2. A method of setting a transmit power of a mobile station in accordance with claim 1, the method further comprising the step of:
   detecting by the mobile station when the transmit power reaches a lower threshold level within a power control range.

3. A method of setting a transmit power of a mobile station in accordance with claim 1, the method further comprising the step of:
   entering into a time discontinuous mode of transmission as the second power control mode, by the mobile station, in response to the message, to enable the mobile station to transmit at a power level below the lower threshold level and remain in communication with the at least one base station.

4. A method of setting the transmit power of a mobile station in accordance with claim 3, wherein the communications system is a Code Division Multiple Access System and the time discontinuous mode is a slotted mode of operation whereby the mobile station transmits at the same power level, in half the time (or any other fraction), thereby reducing the average transmit power.

5. A method of setting the transmit power of a mobile station in accordance with claim 3, wherein the communications system is a Code Division Multiple Access System and the time discontinuous mode is a slot deletion mode of operation.

6. A method of setting the transmit power of a mobile station in accordance with claim 5, wherein the number of slots deleted in the slot deletion mode of operation extends to a frame of information being deleted.

7. A method of setting the transmit power of a mobile station in accordance with claim 3, wherein the communications system is a Code Division Multiple Access System and the time discontinuous mode is a combination of a slotted mode of operation, whereby the mobile station transmits at the same power level, in half the time, thereby reducing the average transmit power and a slot deletion mode of operation, whereby some of the slots in the slotted mode are deleted to further reduce the transmit power of the mobile station.

8. A method of setting the transmit power of a mobile station in accordance with claim 3, wherein in the time discontinuous mode of operation, user data and/or control information is slotted in to available transmit slots.

9. A method of setting a transmit power of a mobile station in accordance with claim 1, the method further comprising the step of:

transmitting, by the mobile station, at a higher data rate as the second power control mode, in response to receiving the message.

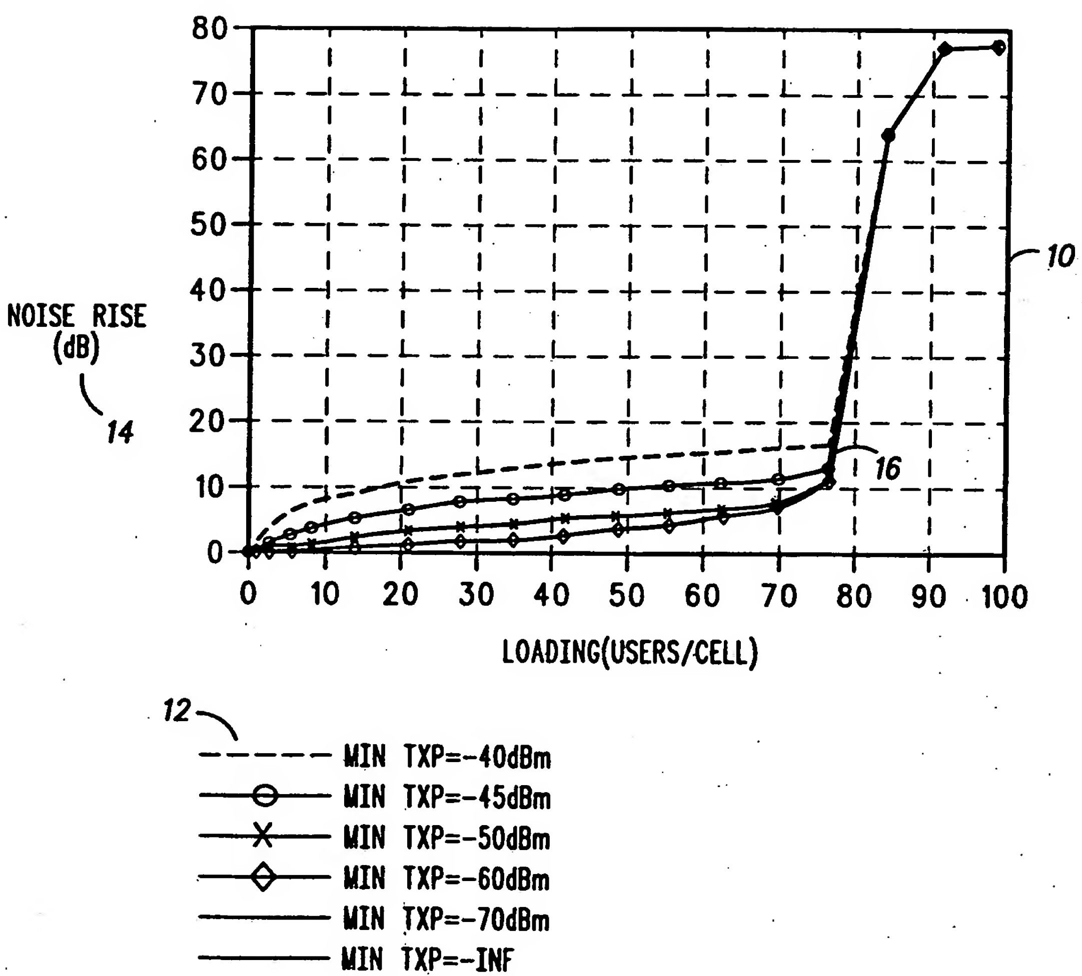
10. A method of setting a transmit power of a mobile station in accordance with claim 1, wherein after the mobile station has entered the second power control mode of operation, the method further comprises the steps of

receiving a second message at the mobile station, the second message requesting the mobile station to increase its transmit power to a level that would correspond to a level above the threshold level for continuous transmission power; and

operating at this increased transmit power level by the mobile station where the increased transmit power level remains outside of a normal closed loop power control function of the first power control mode of operation.

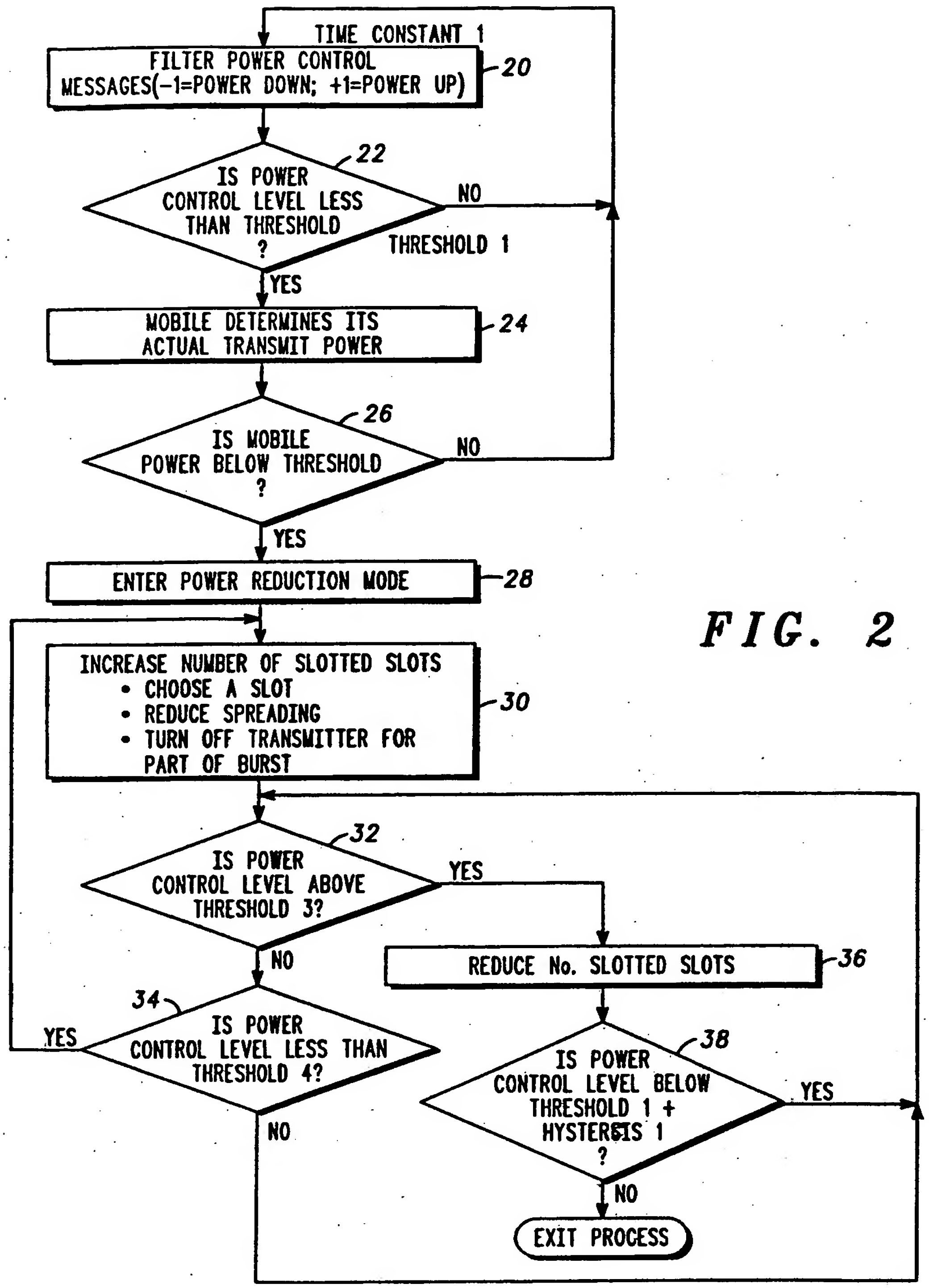
11. A mobile station operating the method according to claim 1.

12. A communications system operating the method according to claim 1.



80
70
60
50
40
30
20
10
0
NOISE RISE
(dB)
14
10
16
0 10 20 30 40 50 60 70 80 90 100
LOADING(USERS/CELL)
12
MIN TXP=-40dBm
MIN TXP=-45dBm
MIN TXP=-50dBm
MIN TXP=-60dBm
MIN TXP=-70dBm
MIN TXP=-INF

FIG. 1



TIME CONSTANT 1
FILTER POWER CONTROL MESSAGES(-1=POWER DOWN; +1=POWER UP)
20
IS POWER CONTROL LEVEL LESS THAN THRESHOLD ?
22
NO
THRESHOLD 1
YES
MOBILE DETERMINES ITS ACTUAL TRANSMIT POWER
24
IS MOBILE POWER BELOW THRESHOLD ?
26
NO
YES
ENTER POWER REDUCTION MODE
28
INCREASE NUMBER OF SLOTTED SLOTS
• CHOOSE A SLOT
• REDUCE SPREADING
• TURN OFF TRANSMITTER FOR PART OF BURST
30
IS POWER CONTROL LEVEL ABOVE THRESHOLD 3?
32
YES
NO
REDUCE No. SLOTTED SLOTS
36
34
IS POWER CONTROL LEVEL LESS THAN THRESHOLD 4?
YES
NO
IS POWER CONTROL LEVEL BELOW THRESHOLD 1 + HYSTERESIS 1 ?
38
YES
NO
EXIT PROCESS

FIG. 2

INTERNATIONAL SEARCH REPORT

Int. ional Application No
PCT/EP 00/10092

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04B7/005

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X A	WO 99 65158 A (RAAF BERNHARD ;SIEMENS AG (DE)) 16 December 1999 (1999-12-16) claims 1-4,11-15 page 7, line 27 - last line; figure 1 page 8, line 27 - line 31 page 9, line 4 - line 23 ---	1-9,11, 12 10
X Y	EP 0 926 842 A (SONY CORP) 30 June 1999 (1999-06-30) abstract; figure 6 column 13, line 5 - line 50; figures 4,5 column 14, line 19 -column 15, line 4 ---	1,2, 10-12 9
	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 March 2001	09/03/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Sieben, S

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Int[...]tional Application No
PCT/EP 00/10092

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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A	column 5, line 35 -column 6, line 10; figure 3	1,2,11, 12
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